CLAIMS

1. A transfected primary or secondary cell of vertebrate origin having stably integrated into its genome:

   a) exogenous DNA which encodes erythropoietin and

   b) DNA sequences, sufficient for expression of the exogenous DNA in the transfected primary or secondary cell,

   the primary or secondary cell capable of expressing erythropoietin.

2. The transfected primary or secondary cell of vertebrate origin of Claim 1 selected from the group consisting of: transfected fibroblasts, transfected keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes, and transfected precursors thereof.

3. The transfected primary or secondary cell of Claim 2 which is of mammalian origin.

4. The transfected primary or secondary cell of Claim 3 selected from the group consisting of: transfected primary human cells, transfected secondary human

cells, transfected primary rabbit cells and transfected secondary rabbit cells.

5. The transfected primary or secondary cell of vertebrate origin of Claim 1 which additionally includes DNA encoding a selectable marker.

6. The transfected primary or secondary cell of Claim 5 selected from the group consisting of: transfected fibroblasts, transfected keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes, and transfected precursors thereof.

7. The transfected primary or secondary cell of Claim 6 which is of mammalian origin.

8. The transfected primary or secondary cell of Claim 7 selected from the group consisting of: transfected primary human cells, transfected secondary human cells, transfected primary rabbit cells, and transfected secondary rabbit cells.

9. The transfected primary or secondary cell of vertebrate origin of Claim 1 selected from the group consisting of:

a) transfected primary or secondary cells which, in their untransfected state, do not make or contain erythropoietin;

b) transfected primary or secondary cells which, in their untransfected state, make or contain erythropoietin in abnormally low amounts or in defective form; and

c) transfected primary or secondary cells which, in their untransfected form, make or contain erythropoietin in physiologically normal amounts.

10. A primary or secondary cell of vertebrate origin transfected with:

a) exogenous DNA which encodes erythropoietin; and

b) DNA sequences, sufficient for expression of the exogenous DNA in the primary or secondary cell,

the sequences of (a) and (b) present in the cell in an episome.

11. The primary or secondary cell of vertebrate origin of Claim 10 selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, muscle cells, hepatocytes, and precursors thereof.

12. The primary or secondary cell of Claim 11 which is of mammalian origin.

13. The primary or secondary cell of Claim 12 selected from the group consisting of: primary human cells, secondary human cells, primary rabbit cells, and secondary rabbit cells.

14. A clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding erythropoietin incorporated therein.

15. The clonal cell strain of Claim 14 wherein the exogenous DNA is stably incorporated into genomic DNA of the transfected secondary cells.

16. The clonal cell strain of Claim 15 wherein the transfected secondary cells are selected from the group consisting of: transfected secondary fibroblasts, transfected secondary keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes, and transfected precursors thereof.

17. The clonal cell strain of transfected secondary cells of Claim 16 wherein the transfected secondary cells are of mammalian origin.

18. The clonal strain of transfected secondary cells of Claim 17 wherein the transfected secondary cells of mammalian origin are selected from the group consisting of: transfected secondary human cells and transfected secondary rabbit cells.

19. The clonal cell strain of Claim 14 wherein the exogenous DNA is present in the transfected secondary cells in an episome.

20. A heterogenous cell strain of transfected secondary cells of vertebrate origin having stably incorporated into their genomes:

a) exogenous DNA encoding erythropoietin and

b) DNA sequences sufficient for expression of the exogenous DNA in the transfected primary or secondary cell.

the heterogenous cell strain capable of expressing erythropoietin.

21. The heterogenous cell strain of Claim 20, wherein the transfected primary or secondary cells are selected from the group consisting of: transfected fibroblasts, transfected keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes, and transfected precursors thereof.

22. The heterogenous cell strain of Claim 21 which is of mammalian origin.

23. A heterogenous cell strain of Claim 22 selected from the group consisting of: transfected primary human cells, transfected secondary human cells, transfected primary rabbit cells, and transfected secondary rabbit cells.

24. A mixture of cells consisting essentially of transfected primary or secondary cells of Claim 1 and untransfected primary or secondary cells.

25. A mixture of cells consisting essentially of transfected primary or secondary cells of Claim 3 and untransfected primary or secondary cells.

26. A method of producing a clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding erythropoietin incorporated therein, comprising the steps of:

a) producing a mixture of cells of vertebrate origin containing primary cells;

b) transfecting primary cells produced in (a) with a DNA construct comprising exogenous DNA encoding erythropoietin and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected primary cells which express the exogenous DNA encoding erythropoietin;

c) culturing a transfected primary cell which expresses the exogenous DNA encoding erythropoietin produced in (b), under conditions appropriate for propagating the transfected primary cell which expresses the exogenous DNA encoding erythropoietin, thereby producing a clonal cell strain of transfected secondary cells from the transfected primary cell.

27. The method of Claim 26 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, muscle cells, hepatocytes, and precursors thereof.

28. The method of Claim 27 wherein the transfected primary cell is of mammalian origin.

29. The method of Claim 28 wherein the primary cell is selected from the group consisting of: primary human cells, and primary rabbit cells.

30. The method of Claim 26 wherein in step (b) the primary cell of vertebrate origin is additionally transfected with DNA encoding a selectable marker.

31. The method of Claim 30 wherein the primary cell is selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, transfected muscle cells, hepatocytes, and precursors thereof.

32. The method of Claim 31 wherein the primary cell is of mammalian origin.

33. The method of Claim 32 wherein the primary cell is selected from the group consisting of: primary human cells and primary rabbit cells.

34. A method of producing a clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding erythropoietin incorporated therein, comprising the steps of:

a) providing a mixture of cells of vertebrate origin containing primary cells;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with a DNA construct comprising exogenous DNA encoding erythropoietin and additional DNA sequences sufficient for expression of the exogenous DNA in the secondary cells, thereby producing transfected secondary cells which express the exogenous DNA encoding erythropoietin; and

d) culturing a transfected secondary cell which expresses the DNA encoding erythropoietin, produced in (c), under conditions appropriate for propagating the transfected secondary cell which expresses the exogenous DNA encoding erythropoietin,

thereby producing a clonal cell strain of transfected secondary cells from the transfected secondary cell of (d).

35. The method of Claim 34 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the

blood, muscle cells, hepatocytes, and precursors thereof.

36. The method of Claim 35 wherein the transfected primary cell is of mammalian origin.

37. The method of Claim 36 wherein the primary cell is selected from the group consisting of: primary human cells and primary rabbit cells.

38. The method of Claim 34 wherein in step (c) the secondary cells of vertebrate origin are additionally transfected with DNA encoding a selectable marker.

39. The method of Claim 38 wherein the primary cell is selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, transfected muscle cells, hepatocytes, and precursors thereof.

40. The method of Claim 39 wherein the primary cell is of mammalian origin.

41. The method of Claim 40 wherein the primary cell is selected from the group consisting of: primary human cells and primary rabbit cells.

42. The method of Claim 34 wherein, in step (c), secondary cells are transfected with the DNA

construct comprising exogenous DNA encoding erythropoietin by combining the primary cells and the DNA construct comprising exogenous DNA encoding erythropoietin and subjecting the resulting combination to electroporation under conditions which result in production of at least one primary cell having exogenous DNA stably integrated into genomic DNA.

43. The method of Claim 42 wherein electroporation is carried out at an electroporation voltage of between 250 and 300 volts and a capacitance setting of approximately 960 μFarads.

44. The method of Claim 34 wherein in step (c) secondary cells are transfected with the DNA construct comprising exogenous DNA by microinjecting the DNA construct comprising exogenous DNA into the secondary cells.

45. The method of Claim 34 wherein in step (c), secondary cells are transfected with the DNA construct comprising exogenous DNA by calcium phosphate precipitation, modified calcium phosphate precipitation, liposome fusion methodologies, receptor mediated transfer, micro-projectile bombardment, and polybrene precipitation.

46. The method of Claim 34 wherein in step (c), the exogenous DNA is introduced into genomic DNA by homologous recombination between DNA sequences

present in the exogenous DNA construct and genomic DNA.

47. The method of Claim 34 additionally comprising transfecting in step (c), second cells produced in step (a) with a DNA construct comprising DNA encoding a selectable marker.

48. A method of producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding erythropoietin stably incorporated into the genome of said secondary cells, comprising the steps of:

a) producing a mixture of cells of vertebrate origin containing primary cells;

b) transfecting primary cells produced in (a) with exogenous DNA encoding erythropoietin and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of primary cells which includes transfected primary cells which express the exogenous DNA encoding erythropoietin;

c) culturing the product of (b) under conditions appropriate for propagation of transfected primary cells which express the exogenous DNA encoding erythropoietin,

thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin

which express the exogenous DNA encoding erythropoietin.

49. The method of Claim 48 wherein the vertebrate is a mammal and and the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, muscle cells, hepatocytes, and precursors thereof.

50. The method of Claim 48 wherein, in step (b), primary cells are transfected with the DNA construct comprising exogenous DNA encoding a therapeutic product by combining the primary cells and the DNA construct comprising exogenous DNA encoding a therapeutic product and subjecting the resulting combination to electroporation under conditions which result in production of at least one secondary cell having exogenous DNA stably integrated into genomic DNA.

51. The method of Claim 50 wherein electroporation is carried out at an electroporation voltage of between 250 and 300 volts and a capacitance setting of approximately 960 μFarads.

52. The method of Claim 48 wherein in step (b) primary cells are transfected with the DNA construct comprising exogenous DNA by microinjecting the DNA construct comprising exogenous DNA into the primary cells.

53. The method of Claim 48 wherein in step (b), secondary cells are transfected with the DNA construct comprising exogenous DNA by a method selected from the group consisting of: calcium phosphate precipitation, modified calcium phosphate precipitation, liposome fusion methodologies, receptor mediated transfer, micro-projectile bombardment, and polybrene precipitation.

54. The method of Claim 48 wherein in step (b) transfected primary cells are produced by introducing into primary cells produced in (a) a construct which undergoes homologous recombination with genomic DNA of the primary cells, thereby resulting in introduction of the construct into the genomic DNA.

55. The method of Claim 48 additionally comprising transfecting in step (b), primary cells produced in step (a) with a DNA construct comprising DNA encoding a selectable marker.

56. A method of producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding erythropoietin stably incorporated into the genome of said secondary cells, comprising the steps of

a) providing a mixture of cells of vertebrate origin containing primary cells;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with exogenous DNA encoding erythropoietin and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of secondary cells which includes transfected secondary cells which express the exogenous DNA encoding erythropoietin;

d) culturing the product of (c) under conditions appropriate for propagation of transfected secondary cells which express the exogenous DNA encoding a therapeutic product,

thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding erythropoietin.

57. The method of Claim 56 wherein the vertebrate is a mammal and and the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, muscle cells, hepatocytes and precursors thereof.

58. The method of Claim 56 wherein, in step (c), secondary cells are transfected with the DNA construct comprising exogenous DNA encoding a therapeutic product by combining the primary cells and the DNA construct comprising exogenous DNA encoding a therapeutic product and subjecting the resulting

combination to electroporation under conditions which result in production of at least one secondary cell having exogenous DNA stably integrated into genomic DNA.

59. The method of Claim 58 wherein electroporation is carried out at an electroporation voltage of between 250 and 300 volts and a capacitance setting of approximately 960 μFarads.

60. The method of Claim 56 wherein in step (c) secondary cells are transfected with the DNA construct comprising exogenous DNA by microinjecting the DNA construct comprising exogenous DNA into the secondary cells.

61. The method of Claim 56 wherein in step (c), secondary cells are transfected with the DNA construct comprising exogenous DNA by a method selected from the group consisting of: calcium phosphate precipitation, modified calcium phosphate precipitation, liposome fusion methodologies, receptor mediated transfer, micro-projectile bombardment, and polybrene precipitation.

62. The method of Claim 58, wherein in step (c) transfected secondary cells are produced by introducing into secondary cells produced in (b) a construct which undergoes homologous recombination with genomic DNA of the secondary cells, thereby

resulting in introduction of the construct into the genomic DNA.

63. The method of Claim 60, wherein in step (c) transfected secondary cells are produced by introducing into secondary cells produced in (b) a construct which undergoes homologous recombination with genomic DNA of the secondary cells, thereby resulting in introduction of the construct into the genomic DNA.

64. The method of Claim 56 additionally comprising transfecting in step (c), secondary cells produced in step (b) with a DNA construct comprising DNA encoding a selectable marker.

65. A method of producing a clonal cell strain of secondary fibroblasts of mammalian origin which express exogenous DNA encoding erythropoietin upon introduction into a mammal, comprising the steps of:

a) providing primary fibroblasts of mammalian origin;

b) producing a population of secondary fibroblasts from the primary fibroblasts provided in (a);

c) combining the secondary fibroblasts of mammalian origin with a DNA construct comprising:

i) exogenous DNA encoding erythropoietin to be expressed in the fibroblasts; and

ii) additional DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in the fibroblasts;

d) subjecting the combination produced in (c) to electroporation under conditions which result in transfection of the vector into the secondary fibroblasts of mammalian origin, thereby producing a mixture of transfected secondary fibroblasts of mammalian origin and non-transfected secondary fibroblasts of mammalian origin;

e) isolating a transfected secondary fibroblast of mammalian origin produced in (d); and

f) culturing the transfected secondary fibroblast of mammalian origin isolated in (e) under conditions appropriate for production of a clonal population consisting essentially of transfected secondary fibroblasts of mammalian origin which express the exogenous DNA encoding erythropoietin.

66. The method of Claim 65 wherein in step (d) electroporation is carried out at an electroporation voltage of between 250 and 300 volts and a capacitance setting of approximately 960 μFarads.

67. The method of Claim 65 further comprising maintaining the product of (f) for sufficient time and under appropriate conditions for at least 20 doublings of the transfected secondary cells which express the exogenous DNA to occur.

68. A method of providing erythropoietin in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) transfecting primary cells obtained in (a) with a DNA construct comprising exogenous DNA encoding erythropoietin and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected primary cells which express the exogenous DNA encoding the therapeutic product;

c) culturing a transfected primary cell which expresses the exogenous DNA encoding erythropoietin produced in (b), under conditions appropriate for propagating the transfected primary cell which expresses the exogenous DNA encoding erythropoietin, thereby producing a clonal cell strain of transfected secondary cells from the transfected primary cell;

d) culturing the clonal cell strain of transfected secondary cells produced in (c) under conditions appropriate for and sufficient time for the clonal cell strain of transfected secondary cells to undergo a sufficient number of doublings to provide a sufficient number of transfected secondary cells to produce an effective amount of erythropoietin; and

e) introducing transfected secondary cells produced in (d) into the mammal in sufficient number to produce an effective amount of erythropoietin in the mammal.

69. The method of providing erythropoietin in an effective amount to a mammal of Claim 68 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, hepatocytes, and precursors thereof.

70. A method of providing erythropoietin in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with a DNA construct comprising exogenous DNA encoding erythropoietin and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected secondary cells which express the exogenous DNA encoding erythropoietin;

d) culturing a transfected secondary cell which expresses the exogenous DNA encoding erythropoietin produced in (c), under conditions appropriate for propagating the transfected secondary cell which expresses the exogenous DNA encoding erythropoietin, thereby producing a clonal cell strain of transfected secondary cells from the transfected secondary cell;

e) culturing the clonal cell strain of transfected secondary cells produced in (d) under conditions appropriate for and sufficient time for the clonal cell strain of transfected secondary cells to undergo a sufficient number of doublings to provide a sufficient number of transfected secondary cells to produce an effective amount of erythropoietin; and

f) introducing transfected secondary cells produced in (e) into the mammal in sufficient number to produce an effective amount of erythropoietin.

71. The method of providing a therapeutic product in an effective amount to a mammal of Claim 70 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, hepatocytes and precursors thereof.

72. A method of producing erythropoietin in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) transfecting primary cells obtained in (a) with exogenous DNA encoding erythropoietin and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of primary

cells which includes transfected primary cells which express the exogenous DNA encoding erythropoietin;

c) culturing the product of (b) under conditions appropriate for propagation of transfected primary cells which express the exogenous DNA encoding erythropoietin, thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding erythropoietin; and

d) introducing transfected secondary cells produced in (c) into the mammal in sufficient number to produce an effective amount of erythropoietin in the mammal.

73. The method of Claim 72, wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, hepatocytes, and precursors thereof.

74. A method of providing erythropoietin in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with exogenous DNA encoding erythropoietin and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of

the exogenous DNA in transfected secondary cells, thereby producing a mixture of secondary cells which includes transfected secondary cells which express the exogenous DNA encoding erythropoietin;

d) culturing the product of (c) under conditions appropriate for propagation of transfected secondary cells which express the exogenous DNA encoding erythropoietin, thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding erythropoietin; and

e) introducing transfected secondary cells produced in (c) into the mammal in sufficient number to produce an effective amount of erythropoietin in the mammal.

75. The method of Claim 74 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, hepatocytes, and precursors thereof.

76. A method of providing erythropoietin to a mammal at biologically significant levels, comprising administering to the mammal transfected primary or secondary cells of mammalian origin which express erythropoietin in sufficient quantity to produce physiologically relevant levels in the mammal.

77. The method of Claim 76 wherein the transfected primary or secondary cells are selected from the group consisting of primary human cells, primary rabbit cells.

78. A transfected primary or secondary cell of vertebrate origin having stably integrated into its genome:

a) exogenous DNA which encodes a glucagon-like peptide 1 related peptide with insulinotropin activity, and

b) DNA sequences, sufficient for expression of the exogenous DNA in the transfected primary or secondary cell,

the primary or secondary cell capable of expressing the glucagon-like peptide 1 related peptide.

79. The transfected primary or secondary cell of vertebrate origin of Claim 78 selected from the group consisting of: transfected fibroblasts, transfected keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes, and transfected precursors thereof.

80. The transfected primary or secondary cell of Claim 79 which is of mammalian origin.

81. The transfected primary or secondary cell of Claim 80 selected from the group consisting of: transfected primary human cells, transfected secondary human cells, transfected primary rabbit cells and transfected secondary rabbit cells.

82. The transfected primary or secondary cell of vertebrate origin of Claim 78 which additionally includes DNA encoding a selectable marker.

83. The transfected primary or secondary cell of Claim 82 selected from the group consisting of: transfected fibroblasts, transfected keratinocytes, transfected epithelial cells, transfected endothelial cells, transfected glial cells, transfected neural cells, transfected formed elements of the blood, transfected muscle cells, transfected hepatocytes and transfected precursors thereof.

84. The transfected primary or secondary cell of Claim 83 which is of mammalian origin.

85. The transfected primary or secondary cell of vertebrate origin of Claim 78 selected from the group consisting of:

a) transfected primary or secondary cells which, in their untransfected state, do not make or contain a glucagon-like peptide 1 related peptide;

b) transfected primary or secondary cells which, in their untransfected state, make or contain a

glucagon-like peptide 1 related peptide in abnormally low amounts or in defective form; and

c) transfected primary or secondary cells which, in their untransfected form, make or contain a glucagon-like peptide 1 related peptide in physiologically normal amounts.

86. A primary or secondary cell of vertebrate origin transfected with:

a) exogenous DNA which encodes a glucagon-like peptide 1 related peptide with insulinotropin activity; and

b) DNA sequences, sufficient for expression of the exogenous DNA in the primary or secondary cell,

the sequences of (a) and (b) present in the cell in an episome.

87. A clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding a glucagon-like peptide 1 related peptide incorporated therein.

88. The clonal cell strain of Claim 87 wherein the exogenous DNA is stably incorporated into genomic DNA of the transfected secondary cells.

89. A heterogenous cell strain of transfected secondary cells of vertebrate origin having stably incorporated into their genomes:

a) exogenous DNA encoding a glucagon-like peptide 1 related peptide with insulinotropin activity and

b) DNA sequences sufficient for expression of the exogenous DNA in the transfected primary or secondary cell,

the heterogenous cell strain capable of expressing a glucagon-like peptide 1 related peptide.

90. A mixture of cells consisting essentially of transfected primary or secondary cells of Claim 78 and untransfected primary or secondary cells.

91. A method of producing a clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding a glucagon-like peptide 1 related peptide incorporated therein, comprising the steps of:

a) producing a mixture of cells of vertebrate origin containing primary cells;

b) transfecting primary cells produced in (a) with a DNA construct comprising exogenous DNA encoding a glucagon-like peptide 1 related peptide and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide; and

c) culturing a transfected primary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide produced in (b), under conditions appropriate for propagating the transfected primary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide,

thereby producing a clonal cell strain of transfected secondary cells from the transfected primary cell.

92. A method of producing a clonal cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding a glucagon-like peptide 1 related peptide incorporated therein, comprising the steps of:

a) providing a mixture of cells of vertebrate origin containing primary cells;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with a DNA construct comprising exogenous DNA encoding a glucagon-like peptide 1 related peptide and additional DNA sequences sufficient for expression of the exogenous DNA in the secondary cells, thereby producing transfected secondary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide; and

d) culturing a transfected secondary cell which expresses the DNA encoding a glucagon-like peptide 1 related peptide produced in (c), under conditions appropriate for propagating the transfected secondary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide,

thereby producing a clonal cell strain of transfected secondary cells from the transfected secondary cell of (d).

93. A method of producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express exogenous DNA encoding a glucagon-like peptide 1 related peptide stably incorporated into the genome of said secondary cells, comprising the steps of:

a) producing a mixture of cells of vertebrate origin containing primary cells;

b) transfecting primary cells produced in (a) with exogenous DNA encoding a glucagon-like peptide 1 related peptide and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of primary cells which includes transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide;

c) culturing the product of (b) under conditions

appropriate for propagation of transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide,

thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide.

94. A method of producing a clonal cell strain of secondary fibroblasts of mammalian origin which express exogenous DNA encoding a glucagon-like peptide 1 related peptide upon incorporation into the genome of the secondary fibroblast, comprising the steps of:

a) providing primary fibroblasts of mammalian origin;

b) producing a population of secondary fibroblasts from the primary fibroblasts provided in (a);

c) combining the secondary fibroblasts of mammalian origin with a DNA construct comprising:

i) exogenous DNA encoding a glucagon-like peptide 1 related peptide to be expressed in the fibroblasts; and

ii) additional DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in the fibroblasts;

d) subjecting the combination produced in (c) to electroporation under conditions which result in transfection of the vector into the secondary fibroblasts of mammalian origin, thereby

producing a mixture of transfected secondary fibroblasts of mammalian origin and non-transfected secondary fibroblasts of mammalian origin;

e) isolating a transfected secondary fibroblast of mammalian origin produced in (d); and

f) culturing the transfected secondary fibroblast of mammalian origin isolated in (e) under conditions appropriate for production of a clonal population consisting essentially of transfected secondary fibroblasts of mammalian origin which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide.

95. A method of Claim 94 wherein the glucagon-like peptide 1 related peptide is a glucan-like peptide 1 derivative selected from the group consisting of GLP-1(7-37), GLP-1(7-36), GLP-1(7-35) GLP-1(7-34) and other truncated carboxy-terminal amidated derivatives and derivatives of GLP-1 which have amino acid substitutions, deletions, additions or other alterations (e.g., addition of a non-amino acid component) which result in biological activity or stability in the blood which is substantially the same as that of a truncated GLP-1 derivative or enhanced biological activity or stability in the blood.

96. A method of providing a glucagon-like peptide 1 related peptide in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) transfecting primary cells obtained in (a) with a DNA construct comprising exogenous DNA encoding a glucagon-like peptide 1 related peptide and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide;

c) culturing a transfected primary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide produced in (b), under conditions appropriate for propagating the transfected primary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide, thereby producing a clonal cell strain of transfected secondary cells from the transfected primary cell;

d) culturing the clonal cell strain of transfected secondary cells produced in (c) under conditions appropriate for and sufficient time for the clonal cell strain of transfected secondary cells to undergo a sufficient number of doublings to provide a sufficient number of transfected secondary cells to produce an effective amount of a glucagon-like peptide 1 related peptide; and

e) introducing transfected secondary cells produced in (d) into the mammal in sufficient number to produce an effective amount of a glucagon-like peptide 1 related peptide in the mammal.

97. The method of providing a therapeutic product in an effective amount to a mammal of Claim 95 wherein the primary cells are selected from the group consisting of: fibroblasts, keratinocytes, epithelial cells, endothelial cells, glial cells, neural cells, formed elements of the blood, hepatocytes and precursors thereof.

98. A method of Claim 97 wherein the glucagon-like peptide 1 related peptide is a glucan-like peptide 1 derivative selected from the group consisting of GLP-1(7-37), GLP-1(7-36), GLP-1(7-35) GLP-1(7-34) and other truncated carboxy-terminal amidated derivatives and derivatives of GLP-1 which have amino acid substitutions, deletions, additions or other alterations (e.g., addition of a non-amino acid component) which result in biological activity or stability in the blood which is substantially the same as that of a truncated GLP-1 derivative or enhanced biological activity or stability in the blood.

99. A method of providing a glucagon-like peptide 1 related peptide in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with a DNA construct comprising exogenous DNA encoding a glucagon-like peptide 1 related peptide and additional DNA sequences sufficient for expression of the exogenous DNA in the primary cells, thereby producing transfected secondary cells which express the exogenous DNA encoding glucagon-like peptide;

d) culturing a transfected secondary cell which expresses the exogenous DNA encoding glucagon-like peptide produced in (c), under conditions appropriate for propagating the transfected secondary cell which expresses the exogenous DNA encoding a glucagon-like peptide 1 related peptide, thereby producing a clonal cell strain of transfected secondary cells from the transfected secondary cell;

e) culturing the clonal cell strain of transfected secondary cells produced in (c) under conditions appropriate for and sufficient time for the clonal cell strain of transfected secondary cells to undergo a sufficient number of doublings to provide a sufficient number of transfected secondary cells to produce an effective amount of a glucagon-like peptide 1 related peptide; and

f) introducing transfected secondary cells produced in (e) into the mammal in sufficient number to produce an effective amount of a glucagon-like peptide 1 related peptide.

100. A method of Claim 99 wherein the glucagon-like peptide 1 related peptide is a glucan-like peptide 1 derivative selected from the group consisting of GLP-1(7-37), GLP-1(7-36), GLP-1(7-35) GLP-1(7-34) and other truncated carboxy-terminal amidated derivatives and derivatives of GLP-1 which have amino acid substitutions, deletions, additions or other alterations (e.g., addition of a non-amino acid component) which result in biological activity or stability in the blood which is substantially the same as that of a truncated GLP-1 derivative or enhanced biological activity or stability in the blood.

101. A method of producing a glucagon-like peptide 1 related peptide in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) transfecting primary cells obtained in (a) with exogenous DNA encoding a glucagon-like peptide 1 related peptide and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of primary cells which includes

transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide;

c) culturing the product of (b) under conditions appropriate for propagation of transfected primary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide, thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide; and

d) introducing transfected secondary cells produced in (c) into the mammal in sufficient number to produce an effective amount of a glucagon-like peptide 1 related peptide in the mammal.

102. A method of Claim 101 wherein the glucagon-like peptide 1 related peptide is a glucan-like peptide 1 derivative selected from the group consisting of GLP-1(7-37), GLP-1(7-36), GLP-1(7-35) GLP-1(7-34) and other truncated carboxy-terminal amidated derivatives and derivatives of GLP-1 which have amino acid substitutions, deletions, additions or other alterations (e.g., addition of a non-amino acid component) which result in biological activity or stability in the blood which is substantially the same as that of a truncated GLP-1 derivative or enhanced biological activity or stability in the blood.

103. A method of providing a glucagon-like peptide 1 related peptide in an effective amount to a mammal, comprising the steps of:

a) obtaining a source of primary cells from the mammal;

b) producing a population of secondary cells from the primary cells provided in (a);

c) transfecting secondary cells produced in (b) with exogenous DNA encoding a glucagon-like peptide 1 related peptide and operatively linked to DNA sequences of non-retroviral origin sufficient for expression of the exogenous DNA in transfected secondary cells, thereby producing a mixture of secondary cells which includes transfected secondary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide;

d) culturing the product of (c) under conditions appropriate for propagation of transfected secondary cells which express the exogenous DNA encoding a glucagon-like peptide 1 related peptide, thereby producing a heterogenous cell strain of transfected secondary cells of vertebrate origin which express the exogenous DNA encoding glucagon-like peptide; and

e) introducing transfected secondary cells produced in (c) into the mammal in sufficient number to produce an effective amount of a glucagon-like peptide 1 related peptide in the mammal.

104. A method of Claim 103 wherein the glucagon-like peptide 1 related peptide is a glucan-like peptide 1 derivative selected from the group consisting of GLP-1(7-37), GLP-1(7-36), GLP-1(7-35) GLP-1(7-34) and other truncated carboxy-terminal amidated derivatives and derivatives of GLP-1 which have amino acid substitutions, deletions, additions or other alterations (e.g., addition of a non-amino acid component) which result in biological activity or stability in the blood which is substantially the same as that of a truncated GLP-1 derivative or enhanced biological activity or stability in the blood.

105. A method of providing erythropoietin in an effective amount to a mammal, comprising introducing into the mammal a barrier device containing:

a) transfected primary cells expressing exogenous DNA encoding erythropoietin,

b) transfected secondary cells expressing exogenous DNA encoding erythropoietin,

c) or both a) and b),

wherein the barrier device is made of a material which permits passage of erythropoietin into the circulation or tissues of the mammal and prevents contact between the immune system of the mammal and the transfected cells contained within the barrier device to a sufficient extent to prevent a deleterious immune response by the mammal.

106. A method of providing erythropoietin in an effective amount to a mammal, comprising introducing into the mammal a DNA construct comprising exogenous DNA encoding erythropoietin and regulatory sequences sufficient for expression of erythropoietin in cells of the mammal, wherein the DNA construct is taken up by cells of the mammal and is expressed therein.

107. The method of Claim 106 wherein the DNA construct is introduced into the mammal by direct injection into muscle.

Add B1